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English Definition
GO

Home
Suggestions

See Also:

resinate
resiniferous
resinoid
resipiscence
res ipsa loquitur
resist
resistance
Resistance
resistance thermometer
resistance welding
resistant
Resistencia
resistive
resistivity
resistless
resistor
resit
res judicata
reskill
Resnais

resistance welding:
in French
in German
in Italian
in Spanish

(symbols)

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resistance welding
noun a welding technique in which the parts to be joined are held together under pressure and heat is produced by passing a current through the contact resistance formed between the two surfaces

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Resistive Welders and Flickers

An Analysis of Solutions Using Ultracapacitors and Active VAR Compensation

1006485

Final Report, October 2001

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REPORT SUMMARY

Observable flicker in lighting can be caused by resistance welding machines, mainly due to the high level of pulse power drawn during the weld operation. This report discusses application of ultracapacitors and high-speed reactive compensation (HSRC) systems to mitigate the problem.

Background
The resistive welder is a highly fluctuating load that consumes a large amount of reactive power. Unlike lighting, which for the most part is a continuous and constant load, resistive welders operate many times a minute and draw large amounts of power for short periods, after which no power is needed. This load can cause lights to flicker, shorten the life of service equipment such as transformers, and force customers to pay large penalties for poor power factor.

Objective
To study the feasibility of using an ultracapacitor as an energy-storage element in a resistance welder with a goal of creating a new solution that can be used to reduce the potential for flicker.

Approach
The project team focused on understanding five main areas: (1) the welding process, (2) conversion equipment, (3) flicker, (4) ultracapacitors, and (5) existing solutions with special emphasis on HSRC. For each area, the team researched requirements, advantages, disadvantages, strengths, and limitations.

First, the team studied welding operations to determine typical power profiles for such operations and key criteria for producing quality welds. Next, existing welder designs were studied as well as the application of welders and grid compatibility issues. Based on this knowledge, the team created a concept welder design with functional and design specifications. Specific emphasis was placed on understanding advantages and disadvantages of existing solutions. Based on the knowledge gained, the team developed a concept specification for a solution based on ultracapacitors. This specification was then compared to the existing HSRC solution.

The investigation's focus was resistive welding because of the large market and also because of the deep penetration of this type of welder within the industry. Other types of welding exist, such as capacitive-discharge welding. However, because of their small market size, other types of welding technologies were not included in this study.

Results
Research revealed that an existing technology enables ultracapacitors to be integrated into a system that would solve flicker and other power quality problems when the system is integrated into a resistive welder. Ultracapacitors are unique in their good energy density and excellent

power density. Furthermore, the sealed and modular construction of ultracapacitors allows for a rugged and reliable system that can meet the rigorous electrical and environmental requirements of resistive welding.

Ultracapacitors are not an end product by themselves but must be combined with power electronics that shape the energy and power contained within ultracapacitors so that they are useful to the welding equipment. Therefore, it was recognized that power electronics were needed. Fortunately, power electronics at the voltage and current levels and in the configurations necessary to properly utilize the ultracapacitor energy are readily available.

A resistive welder is a mostly reactive load. This means that the welder requires delivery of volt-ampere-reactives (VARs) rather than real power. This puts ultracapacitor technology in a very favorable light because they are power rich but energy poor. The net result is that adding ultracapacitors is very cost-effective. However, power electronics are not as cost-effective because they must be sized for both VARs and kW—in other words, they must be sized for both real and reactive power. The duty cycle of a resistive welder is low (typically only five to ten percent), which does reduce the cost of electronics because of reduced thermal requirements. Still, the large amount of power drawn by resistive welders requires expensive electronics.

The flicker-solving system based on ultracapacitors was compared to an existing solution based on real-time switching of power-factor-correction capacitors. Mainly due to the cost of power electronics in the ultracapacitor-based system, HSRC would be an order of magnitude lower in cost. And, because power electronics technology is mature, the cost of power electronics is predicted to decrease from 10 to 20% over the next few years. Such a cost reduction is significant, but still leaves the solution based on ultracapacitors cost-prohibitive.

This study does not recommend ultracapacitors for resistive welding applications at this time. However, there are many niche markets in the welding industry that require unique solutions. It is possible, especially for capacitor-discharge welding, that an application could be found.

EPRI Perspective

By providing utilities with a technical understanding of the performance and application of ultracapacitors and HSRC systems to the problem of flicker in resistive welding equipment, EPRI is enabling utilities to better service numerous key customer segments. With knowledge of state-of-the-art technology, electric utilities are in a unique position to help their customers value and implement new power quality mitigation solutions using solutions that may be more cost-effective or better than those based on traditional technologies.

Keywords

Supercapacitor
Ultracapacitor
Power Quality
Resistive Welding
Reactive Compensation

ABSTRACT

Observable flicker in lighting can be caused by resistance welders, mainly due to the high level of pulse power drawn during the weld operation. Operation of this type of load can cause the lights to flicker, shorten the life of service equipment such as transformers, and force customers to pay large penalties for poor power factor. The objective of this project was to study the feasibility of using an ultracapacitor as an energy-storage element within a resistance welder with the goal of creating a new solution that can be used to reduce the potential for flicker. The research revealed that an existing technology enables the ultracapacitor to be integrated into a system that would solve flicker and other power quality problems when the system is integrated into a resistive welder. However, it was discovered that while the cost of the ultracapacitor was low, the cost of power electronics would make the system based on ultracapacitors cost prohibitive at this time, especially when compared to a real-time reactive control system.

E-8 Tools and Student Machine Shop

General
Intro
General Rules
Shop Cam
Videos

Proctors
Hours
Contact List

Students
Due Dates
Groups

Tools
Hammer
Screwdriver
Tool Tray

Shops
Machine Shop
Sheet Metal
Wood Shop
Shop Rules

Other
Cutting Speeds
Drill Bits
Glossary
Materials
Shopping

Spot Welder

The spotwelder is used to weld two thin steels together. The welder clamps the two pie passes a high current through them. The electrical resistance of the material causes it tc melt to itself.

This is also called resistive welding. An example of good weld sizes follows below.

1. Place the material on the lower weld contact.
2. Press foot pedal down just until the contacts meet the material to be welded.
3. Now press the foot pedal down **quickly** until it stops and **quickly** release.

The dime is next to the best welds.

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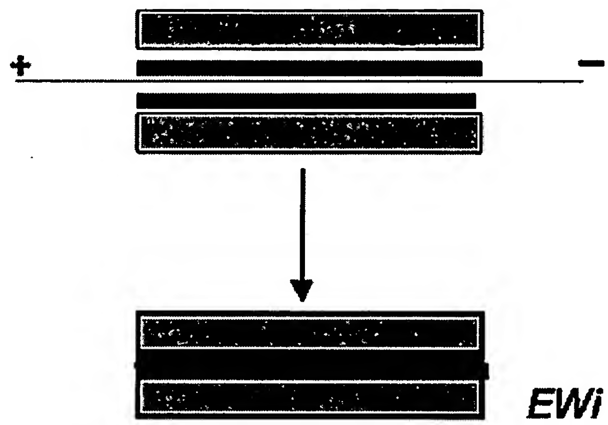
Resistive Implant Welding

Resistive implant welding is observed when an electrically conducting element is h
line by application of a current (see figure). The region around the element melts a
created by the application of pressure. Sometimes, it is beneficial to include additi
the bond line to provide for better melt flow and filling of gaps in the bond line.



Power supplies range from simple variable voltage transformers to programmable
operate in either the AC or DC mode. The resistive element can be any material th
current, including metal wires and braids, and carbon-based elements, such as ta
sheets. This process has normally been applied to larger structures and to those t
a closed-loop weld joint.

Implant welding has been applied to complicated joints in automotive applications
bumpers and panels, joints in plastic pipe, containers and medical devices, such a
oxygenators. Implant heating processes are reasonably fast, from seconds to min
on the application, and the processes can be used to join most thermoplastic-base
Implant materials should be compatible with the intended application, since they re
line.